

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
25 August 2005 (25.08.2005)

PCT

(10) International Publication Number  
**WO 2005/078840 A1**

(51) International Patent Classification<sup>7</sup>: **H01M 8/02**,  
8/04, 8/10

(21) International Application Number:  
PCT/US2005/003357

(22) International Filing Date: 4 February 2005 (04.02.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
102004005935.7 6 February 2004 (06.02.2004) DE  
60/570,052 11 May 2004 (11.05.2004) US

(71) Applicant (for all designated States except US): **BALLARD POWER SYSTEMS AG** [DE/DE]; Neue Strasse 95, 73230 Kirchheim-Nabern (DE).

(71) Applicant (for ZW only): **BALLARD POWER SYSTEMS CORPORATION** [US/US]; 15001 Commerce Drive North, Dearborn, MI 48120 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **LIMBECK, Uwe** [DE/DE]; Milcherberg 9, 73230 Kirchheim unter Teck (DE).

(74) Agents: **HERMANN, Karl, R.** et al.; Seed Intellectual Property Law Group PLLC, Suite 6300, 701 Fifth Avenue, Seattle, WA 98104-7092 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

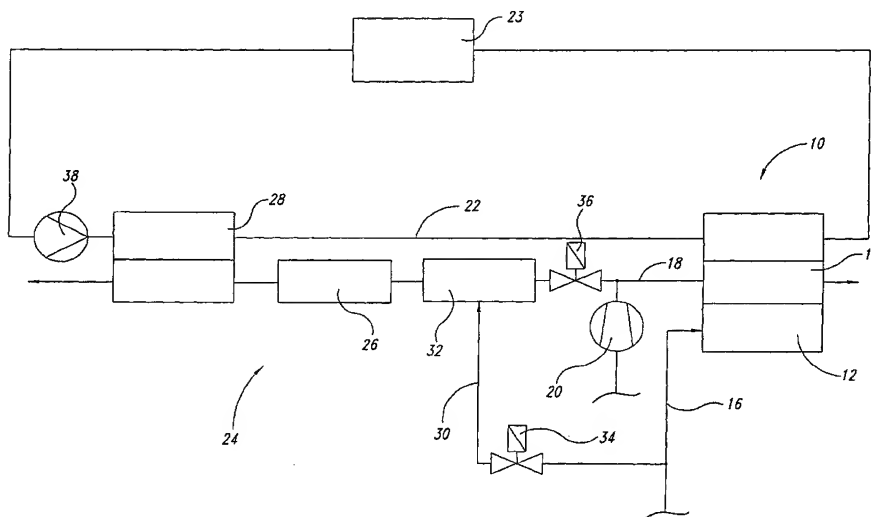
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

[Continued on next page]

(54) Title: METHOD TO COLD-START A FUEL CELL SYSTEM AT SUB-ZERO TEMPERATURES



(57) Abstract: The invention concerns a method to cold-start a fuel cell system at subzero temperatures, whereby the fuel cell system comprises a fuel cell stack, upstream of which is connected a heating device to heat a cooling agent to be circulated by a coolant pump. To reduce the demand for stored electrical energy, a cold fuel cell stack is operated at such a capacity that it generates sufficient power to operate the heating device and the coolant pump; the power generated by the fuel cell stack is used to operate the heating device for heating the cooling agent as well as the coolant pump, whereby the coolant pump circulates the cooling agent between the fuel cell stack and the heating device; and the heating device is switched off as soon as the fuel cell stack reaches a preset temperature that is higher than the original temperature.

WO 2005/078840 A1



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*